



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/675,642	09/30/2003	Patrick C. Herbert	02AB062	6060
7590 04/05/2005				
Susan M. Donahue Rockwell Automation, Inc. 1201 South Second Street Milwaukee, WI 53204		EXAMINER ELLINGTON, ALANDRA		
		ART UNIT 2855		PAPER NUMBER

DATE MAILED: 04/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/675,642

Applicant(s)

HERBERT ET AL.

Examiner

Alandra Ellington

Art Unit

2855

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 and 30-41 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-12, 15-28 and 31-41 is/are rejected.
- 7) ☒ Claim(s) 13, 14, 29, 30 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 September 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 2/17/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Specification

1. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

2. The abstract of the disclosure is objected to because it contains less than the standard range of words. Correction is required. See MPEP § 608.01(b).

3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

- a. The following title is suggested: *Microelectromechanical Strain Gauge with Frequency Detecting Means*.

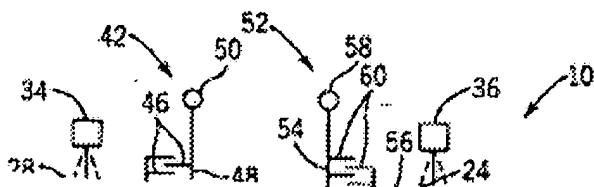
Claim Objections

4. The numbering of claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution. When claims are canceled, the remaining claims must not be renumbered. When new claims are presented, they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

- a. Claim 29 is missing.

Drawings

5. The drawings are objected to because reference characters 10, 42 and 52 all appear to be pointing to same elements.



Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 25-28, 31 and 36 are rejected under 35 U.S.C. 102(b) as being anticipated by Guckel (5,188,983).

a. With respect to Claim 25, Guckel discloses a method for sensing the strain of an object using a MEMS strain gauge including a longitudinally extending beam suspended over a substrate by an arm connected at two separated ends to the substrate along a transverse axis, the method comprising the steps of: A) attaching the substrate 31 to the object with the transverse axis aligned with a direction of strain measurement in the object so that strain of the object causes strain in the substrate 31; B) providing a momentary force to the arm 34, thereby causing the arm 34 to vibrate at a frequency, wherein the frequency of vibration is dependent upon the strain of the substrate 31 and object; C) measuring the frequency of vibration; and D) based on the measured frequency of vibration, determining the strain of the object (col. 4 lines 64-68, col. 5 lines 1-21,40-49).

b. With respect to Claim 26, Guckel discloses the method as recited in claim 26, wherein step (B) further comprises causing the arm 34 to vibrate at a resonant frequency (col. 5 lines 10-21, col. 5 lines 40-49).

c. With respect to Claim 27, Guckel discloses the method as recited in claim 27, wherein step (C) further comprises measuring the resonant frequency of vibration (col. 5 lines 10-21, col. 5 lines 40-49).

d. With respect to Claim 28, Guckel discloses the method as recited in claim 28, wherein step (D) further comprises determining the strain of the object based on the measured resonant frequency of vibration (col. 5 lines 10-21, col. 5 lines 40-49).

e. With respect to Claim 31, Guckel discloses a microelectromechanical system (MEMS) strain gauge providing measurement of strain of an object, the strain gauge comprising: a substrate 31 having a surface attachable to the object; at least one flexible arm 34 having first and second ends attached to the substrate 31, wherein the arm 34 oscillates in response to a stimulus; and a detector communicating with the arm 34 for detecting a frequency of oscillation of the arm to provide a measure of strain of the object (col. 4 lines 45-55, col. 5 lines 40-52, col. 10 lines 42-68, col. 11 lines 1-22).

f. With respect to Claim 36, Guckel discloses the MEMS strain gauge as recited in claim 31, further comprising an actuator 110 capable of applying a force causing the flexible arm 88 to oscillate (col. 10 lines 64-68, col. 11 lines 1-5 {Fig. 23}).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gianchandani (6,606,913) (hereinafter Gian) in view of Guckel et al (5,188,983) (hereinafter Guckel).

a. With respect to Claim 1, Gian discloses a micromachined strain sensor with a substrate 22 having a surface attachable to the object 116 ({Figs. 1,9,10,13}); a longitudinally extending beam 21; and at least one flexible arm 24 having first and second ends 25 attached to the substrate 22 and having a middle portion supporting the beam 21 above the substrate 22 (col. 5 lines 59-67, col. 6 lines 1-3,7-17,23-27,39-41 {Figs. 1,9,10}). However, Gian does not specifically teach a detector communicating with the beam for detecting a frequency of vibration of the beam to provide a measure of strain of the object. Guckel teaches micromechanical sensor with a detector communicating with a beam 34 for detecting a frequency of vibration of the beam 34 to provide a measure of strain of an object (col. 4 lines 45-55, col. 5 lines 10-21,40-52). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Gian with the teachings of Guckel to include a detector communicating with a beam for detecting a frequency of vibration of the

Art Unit: 2855

beam for the purpose of generating a signal indicative of the vibrations of the beam (see Guckel, col. 4 lines 45-55, col. 5 lines 10-21,40-52).

b. With respect to Claim 2, Guckel teaches a resonant frequency of vibration of the beam 34 (col. 5 lines 40-52).

10. Claims 3-12 and 18-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gian (6,606,913) in view of Guckel (5,188,983) as applied to claim 1 above, and further in view of Lewis (5,583,290).

a. With respect to Claim 3, Gian discloses a micromachined strain sensor with a substrate 22 having a surface attachable to the object 116 ({Figs. 1,9,10,13}); a longitudinally extending beam 21; and at least one flexible arm 24 having first and second ends 25 attached to the substrate 22 and having a middle portion supporting the beam 21 above the substrate 22 (col. 5 lines 59-67, col. 6 lines 1-3,7-17,23-27,39-41 {Figs. 1,9,10}). Guckel teaches micromechanical sensor with a detector communicating with a beam 34 for detecting a frequency of vibration of the beam 34 to provide a measure of strain of an object (col. 4 lines 45-55, col. 5 lines 10-21,40-52). However, Gian in view of Guckel does not specifically teach a first actuator communicating with the beam to apply a force to the beam. Lewis teaches a micromechanical apparatus with a first actuator communicating with the beam 12 (col. 4 lines 62-67, col. 5 lines 1-22). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Gian in view of Guckel with the

teachings of Lewis to include a first actuator communicating with the beam to apply a force to the beam for the purpose of applying a force to the beam (see Lewis, col. 4 lines 62-67, col. 5 lines 1-22).

b. With respect to Claim 4, Lewis teaches a second actuator connected to the beam 12 for providing a force to the beam 12 in a direction opposite the force provided by the first actuator (col. 4 lines 62-67, col. 5 lines 1-4).

c. With respect to Claim 5, Lewis teaches a set of movable capacitor plates connected to the beam 12 and a set of stationary capacitor plates in opposition to the movable capacitor plates and a capacitance sensing circuit 112 (col. 4 lines 53-67, col. 5 lines 1-4).

d. With respect to Claim 6, Guckel teaches the applied force induces vibration in the beam 34 (col. 4 lines 45-55, col. 5 lines 10-21,40-52).

e. With respect to Claim 7, Guckel teaches an impulse that induces vibration in the beam 34 at a resonant frequency of the beam 34 (col. 10 lines 42-47,50-59,63-68, col. 11 lines 1-5).

f. With respect to Claim 8, Lewis teaches a set of movable capacitor plates connected to the beam 12 and a set of stationary capacitor plates in opposition to the movable capacitor plates (col. 5 lines 52-67, col. 6 lines 1-20).

g. With respect to Claim 9, Lewis teaches the movable and stationary capacitor plates have interdigitating fingers 20,22 ({Fig. 2}).

h. With respect to Claim 10, Lewis teaches a pulse generator connected across the movable and stationary capacitor plates and operable to momentarily

charge the capacitor plates to produce the force (col. 5 lines 52-67, col. 6 lines 1-20 {Fig. 4}).

i. With respect to Claims 11 and 12, Lewis teaches an oscillator 200 connected across the movable and stationary capacitor plates (col. 5 lines 52-67, col. 6 lines 1-20 {Fig. 4}).

j. With respect to Claim 18, Gian discloses the beam 21 is centered on the arm 24 between the first and second ends 25 of the flexible arm 24 (col. 5 lines 59-67, col. 6 lines 1-3,7-17,23-27,39-41 {Figs. 1,9,10}).

k. With respect to Claim 19, Gian discloses the flexible arm 24 supports the beam 21 at a first end of the beam 21, and wherein the strain gauge further includes a second flexible arm 24 having first and second ends 25 attached to the substrate 22 and having a middle supporting the beam 21 above the substrate 22 at a second end of the beam 21 (col. 5 lines 59-67, col. 6 lines 1-3,7-17,23-27,39-41 {Figs. 1,9,10}).

l. With respect to Claim 20, Gian discloses the arm 24 is electrically isolated from the object 116 ({Figs. 1,9,10,13}).

m. With respect to Claim 21, Guckel teaches the arm 41 is electrically isolated from the detector (col. 4 lines 45-55, col. 5 lines 10-21,40-52 {Figs. 1,2}).

n. With respect to Claim 22, Lewis teaches the arm is electrically isolated from the first actuator (col. 4 lines 62-67, col. 5 lines 1-22).

o. With respect to Claim 23, Gian discloses at least a portion of the beam 21 is insulating (col. 5 lines 61-67).

p. With respect to Claim 24, Gian a second flexible arm 24 having first and second ends 25 attached to the substrate 22 and having a middle supporting the beam 21 above the substrate 22 (col. 5 lines 59-67, col. 6 lines 1-3,7-17,23-27,39-41 {Figs. 1,9,10}). Guckel teaches detector communicating with the arm for detecting a frequency of vibration of the second arm to provide a measure of strain of the object (col. 4 lines 45-55, col. 5 lines 10-21,40-52).

11. Claims 35 and 37-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Guckel (5,188,983) in view of Lewis (5,583,290).

a. With respect to Claim 35, Guckel discloses a microelectromechanical system (MEMS) strain gauge providing measurement of strain of an object, the strain gauge comprising: a substrate 31 having a surface attachable to the object; at least one flexible arm 34 having first and second ends attached to the substrate 31, wherein the arm 34 oscillates in response to a stimulus; and a detector communicating with the arm 34 for detecting a frequency of oscillation of the arm to provide a measure of strain of the object (col. 4 lines 45-55, col. 5 lines 40-52, col. 10 lines 42-68, col. 11 lines 1-22). However, Guckel does not teach a flexible arm carrying a plurality of capacitor fingers, and wherein the detector comprises a capacitor plate carrying a plurality of capacitor fingers interdigitating with the capacitor fingers of the flexible arm. Lewis teaches a flexible arm carrying a plurality of capacitor fingers 20,22, and wherein the detector comprises a capacitor plate carrying a plurality of capacitor fingers 20,22

interdigitating with the capacitor fingers 20,22 of the flexible arm (col. 3 lines 65-67, col. 4 lines 1-30 {Fig. 2}). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Guckel with the teachings of Lewis to include a flexible arm carries a plurality of capacitor fingers, and wherein the detector comprises a capacitor plate carrying a plurality of capacitor fingers interdigitating with the capacitor fingers of the flexible arm for the purpose of forming a capacitor in order to alter the capacitance between each finger (see Lewis, col. 3 lines 65-67, col. 4 lines 1-30 {Fig. 2}).

b. With respect to Claim 37, Lewis teaches the arm carrying a plurality of capacitor fingers 20,22, and wherein the actuator comprises a capacitor plate carrying a plurality of capacitor fingers 20,22 that are interdigitated with the capacitor fingers 20,22 of the arm (col. 3 lines 65-67, col. 4 lines 1-30,50-67, col. 5 lines 1-22 {Fig. 2}).

c. With respect to Claim 38, Guckel discloses a momentary voltage is applied across the capacitor plate (col. 10 lines 50-59).

d. With respect to Claim 39, Lewis teaches the capacitance across the interdigitated fingers 20,22 being sensed after the voltage is applied (col. 4 lines 11-30,40-47,50-67, col. 5 lines 1-22).

e. With respect to Claim 40, Guckel discloses an oscillation frequency is determined based on the sensed capacitance (col. 10 lines 50-68, col. 11 lines 1-22).

- f. With respect to Claim 41, Guckel discloses the strain is determined based on the oscillation frequency (col. 10 lines 50-68, col. 11 lines 1-22).

Allowable Subject Matter

12. Claims 13, 14 and 30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

13. The following is a statement of reasons for the indication of allowable subject matter: The reasons for the indication of allowable subject matter are based on the inclusion of:

- a. In Claim 13, a *microprocessor coupled to the detector to calculate the strain at the arm as a function of the amplitude of motion of the beam as it vibrates at the predetermined frequency.*
- b. In Claim 14, a *microprocessor coupled to the detector to calculate the strain at the arm as a function of the resonant frequency of the arm.*
- c. In Claim 30, step (D) further comprises *adjusting a displacement of the arm to maintain the vibration at a predetermined frequency, and determining the strain based on the amount of displacement.*

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

(5,565,625) (5,786,621) (5,763,782) (5,646,347) (5,610,335) (5,767,405)

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alandra Ellington whose telephone number is (571) 272-2178. The examiner can normally be reached on Monday - Friday, 7:30am - 4:00pm.

16. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Lefkowitz can be reached on (571) 272-2180. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

17. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Alandra Ellington
Art Unit 2855

ane



MAX NOORI
PRIMARY EXAMINER